REMARKS

Status Of Application

Claims 1-18 are pending in the application; the status of the claims is as follows:

Claims 4, 9, 13, and 18 are rejected under 35 U.S.C. § 112, second paragraph, as being allegedly indefinite;

Claims 1, 2, 5, 10, 11, and 14-16 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,068,752 to Dubrow et al.;

Claims 3, 12, and 17 are rejected under 35 U.S.C. § 102(b) as being anticipated by Dubrow as evidenced by Wikipedia;

Claims 6, 7, and 9 are rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,602,791 B2 to Ouellet et al.; and

Claim 8 is rejected under 35 U.S.C. § 102(e) as being anticipated by Quellet as evidenced by Wikipedia.

The acknowledgement, in the Office Action, of a claim for foreign priority under 35 U.S.C. § 119(a)-(d), and that the certified copy of the priority document has been received, is noted with appreciation.

The indication, in the Office Action, that the Examiner has no objections to the drawings filed on September 17, 2003, is noted with appreciation.

By this response, claims 4, 9, 13, and 18 have been amended to address the section 112 rejections thereof and claims 1, 6, 10, and 15 have been amended to more clearly point out and distinctly claim the invention.

35 U.S.C. § 112 Rejection

The rejection of claims 4, 9, 13, and 18 under the second paragraph of 35 U.S.C. § 112 as being indefinite for failing to particularly point out and distinctly claim the subject

matter which Applicants regard as the invention, is respectfully traversed based on the following.

The examiner has interpreted claims 4, 13 and 18 as implying that a member is positioned "between" the pump unit and the channel unit and that this would contradict claims 1, 10 and 15. However, what is intended by these claims is to say that there is a member which helps to set the position of the pump unit and the channel unit in, for example, a predetermined positional relationship with respect to each other. To clarify this intention, claims 4, 13 and 18 have been amended to recite: "a member for positioning the pump unit and the channel unit with respect to each other."

The examiner has also interpreted claim 9 as a member positioned "between" the pump unit and the channel unit. However, once again, the intention is to describe a member which helps position the components with respect to each other. To clarify this intention, claim 9 has been amended to recite: "a member for positioning the sheet-like member and the channel unit with respect to each other."

Accordingly, in view of these amendments, it is respectfully requested that the rejection of claims 4, 9, 13, and 18 under the second paragraph of 35 U.S.C. § 112 be reconsidered and withdrawn.

35 U.S.C. § 102(b) & (e) Rejections

The rejection of claims 1, 2, 5, 10, 11, and 14-16 under 35 U.S.C. § 102(b) as being anticipated by Dubrow et al., is respectfully traversed based on the following.

The present application discloses various embodiments of a microfluidic invention which provides a simplified structure and certain advantages in configuration and use. Certain advantages are obtained by the specific configuration and placement of the pump unit relative to the channel unit. Specifically, the pumping mechanism is not provided on the side of the system that houses the fluid reservoir, but, instead, is located on the side with the pump

unit. In this way, the driving portion of the mechanism is an independent element which can be detached from the channel unit. As described in the present specification, being able to detach the channel unit allows for easy cleaning or replacement, and allows the pumping unit to be reused.

This configuration also addresses other problems faced in other art and lessens the amount dead volume between the pump and the channel unit thereby enhancing response and precise control of the liquids being transported.

These features can be seen in claim 1 which, as amended herein, recites:

> A microfluidic device comprising:
> a pump unit including:
> a first joint surface;
> a pumping mechanism; and
> a channel that forms a flow path through which a fluid flows, opposing ends of said channel each opening to the first joint surface, said pumping mechanism being disposed adjacent to said channel and being configured to control a flow of fluid through said channel; and
> a channel unit including a second joint surface for being detachably joined to the first joint surface and a channel that opens to the second joint surface and is connectable to one end of the channel of the pump unit,
> wherein at least one of a material constituting the first joint surface and a material constituting the second joint surface is an elastic material having a self-sealing feature.

Thus, the invention of claim 1 includes a pump unit having several parts and a channel unit. The pump unit is specifically configured to address some of the matters described above. Specifically, as set forth in the claim, the pump unit includes a first joint surface and a channel through which the fluid is moved by the pumping mechanism. Importantly, the channel has opposing ends, **both** of which open to the first joint surface.

In this configuration, fluid may be drawn from a reservoir which may be is located on the side of the channel unit, received at the pump unit at the first joint surface, moved through the channel of pump unit by virtue of the pumping mechanism and returned to the channel

unit, again at the first joint surface. This configuration allows a clean separation along the first joint surface between the pump unit and both the source of the fluids and the channels into which the fluids are delivered by the pump unit.

In order to anticipate claim 1, the cited reference must disclose every limitation of the claim. As explained more fully below, Dubrow does not disclose every limitation of claim 1 and thus cannot anticipate this claim (or claims 2 and 5, which depend from claim 1).

Dubrow discloses various configurations of microfluidic devices. The structure of all of the systems disclosed comprise a substrate 302, which has various channels fabricated into the surface thereof and a second planar layer which overlays the substrate. The second planar layer has holes disposed through it to form the various reservoirs. (See Fig. 3 and col. 16).

As a primary form of moving the fluid, Dubrow discloses the technique of applying a voltage between the reservoir and the channel to cause fluid flow by electrophoretic transport. Such an electrophoretic transport system is unable to read on the specific structural limitations of claim 1 which requires, among other things, a pumping unit having a channel with a defined configuration, a pumping mechanism, etc.

Dubrow also states that fluid may be transported in this structure by pressure or pneumatically driven systems, including micropumps. However, Dubrow does not disclose or describe any particular structure for employing pressure or pneumatically driven systems, or micropumps. Instead, at best, Dubrow implies that the fluid in the reservoirs can be forced by pressure or a pump into the underlying channels in the substrate.

This disclosure by Dubrow does not show the specific aspects of the microfluidic device and pump unit recited by claim 1. Specifically, among other things, Dubrow does not disclose a pumping unit that includes:

a first joint surface;
a pumping mechanism; and
a channel that forms a flow path through which a fluid flows, opposing ends of said channel each opening to the first joint surface, said pumping mechanism being disposed adjacent to said channel and being configured to control a flow of fluid through said channel;

That is, the disclosure of Dubrow does not suggest a configuration including a pump unit having a channel with opposing ends of the pump channel both opening to the first joint surface. As noted above, a configuration such as claimed in claim 1 allows the fluid to be drawn into the pump at the first joint surface and also delivered to the channel unit at the same surface. In addition, claim 1 also requires that the channel unit include a second joint surface for being detachably joined to the first joint surface where the material of either the first joint surface or the second joint surface is an elastic material having a self-sealing feature. Dubrow also does not disclose a system where the channel unit is detachably joined to the first joint surface.

Because Dubrow does not disclose these limitations of claim 1, Dubrow cannot anticipate claim 1 or claims 2 and 5, which depend from claim 1.

Claim 10 also is directed to a microfluidic invention and, more particularly, to a pump unit of the type which is used with a channel unit in a microfluidic device. Claim 10, as amended herein, recites:

A pump unit used for a microfluidic device including the pump unit and a channel unit that has a joint surface and a channel opening to the joint surface, the pump unit comprising:
a first joint surface for being detachably joined to the joint surface of the channel unit;
a pumping mechanism; and
a channel that forms a flow path through which a fluid flows, opposing ends of said channel each opening to the first joint surface, said pumping mechanism being disposed adjacent to said channel and being

configured to control a flow of fluid through said channel, one end of said channel being connectable to the channel of the channel unit,

wherein a material constituting the first joint surface is an elastic material having a self-sealing feature.

Thus, the pump unit of claim 10 includes a first joint surface and a channel through which the fluid is moved by the pumping mechanism. Importantly, the channel has opposing ends, **both** of which open to the first joint surface.

In this configuration, fluid may be drawn from a reservoir which may be is located on the side of the channel unit, received at the pump unit at the first joint surface, moved through the channel of the pump unit by virtue of the pumping mechanism and returned to the channel unit, again at the first joint surface. This configuration allows a clean detachable separation along the first joint surface between the pump unit and a channel unit that may be used with the pump unit.

As noted above with respect to the rejection of claim 1, Dubrow does not disclose a system having any particular configuration of pump. Instead, at best, Dubrow implies that the fluid in the reservoirs can be forced by pressure or a pump into the underlying channels in the substrate. Dubrow does not suggest a pump unit have a specific configuration including a pump channel where opposing ends of the pump channel are both on the first joint surface. Dubrow also does not suggest a configuration where the pump unit is configured to be detachably joined to the joint surface of the channel unit or that a material of the first joint surface is an elastic material having a self-sealing feature to facilitate sealing along the detachable surface.

Because Dubrow does not disclose these limitations of claim 10, Dubrow cannot anticipate claim 10 or claims 11 and 14, which depend from claim 10.

Claim 15 also is directed to a microfluidic invention and, more particularly, to a channel unit of the type which is used with a pump unit in a microfluidic device. Claim 15, as amended here, recites:

A channel unit used for a microfluidic device including the channel unit and a pump unit, the pump unit being the type that has a first joint surface, a pumping mechanism, and a channel that forms a flow path through which a fluid flows, opposing ends of said channel each opening to the first joint surface, the channel unit comprising:

a second joint surface for being detachably joined to the joint surface of the pump unit; and

a channel that opens to the second joint surface and is connectable to the channel of the pump unit,

wherein a material constituting the second joint surface is an elastic material having a self-sealing feature.

Thus, as presented herein, claim 15 is directed to a channel unit configured to be used with a pump unit of the type that has a first joint surface, a pumping mechanism, and a channel that forms a flow path through which a fluid flows, where opposing ends of the channel each open to the first joint surface.

As addressed above with respect to claims 1 and 10, Dubrow does not disclose a system having any particular configuration of pump. Instead, at best, Dubrow implies that the fluid in the reservoirs can be forced by pressure or a pump down into the underlying channels in the substrate. Dubrow does not suggest a pump unit having a pump channel with a configuration where opposing ends of the pump channel are both on the first joint surface. Dubrow also does not suggest a configuration where the channel unit is configured to be detachably joined to the joint surface of the pump unit where the material of the second joint surface is an elastic material having a self-sealing feature to facilitate sealing along the detachable surface.

Because Dubrow does not disclose these limitations of claim 15, Dubrow cannot anticipate claim 15 or claim 15 which depends from claim 15.

Accordingly, it is respectfully requested that the rejection of claims 1, 2, 5, 10, 11, and 14-16 under 35 U.S.C. § 102(b) as being anticipated by Dubrow et al., be reconsidered and withdrawn.

The rejection of claims 3, 12, and 17 under 35 U.S.C. § 102(b) as being anticipated by Dubrow et al. as evidenced by Wikipedia, is respectfully traversed based on the following.

Claims 3, 12, and 17 depend from claims 1, 10 and 15, respectively. In order to anticipate or render obvious these claims, Dubrow and the cited Wikipedia section, singly or in combination, would need to disclose every limitation of the claims.

As noted above with respect to claims 1, 10 and 15, Dubrow fails to disclose every limitation of these claims. The cited Wikipedia section is relied on for the proposition that PDMS is translucent. However, regardless of whether or not the cited Wikipedia section discloses that PDMS is translucent, the cited Wikipedia section does not disclose or suggest the limitations of claims 1, 10 and 15, which have been identified above as missing from the Dubrow reference.

Accordingly, because Dubrow fails to anticipate claims 1, 10 and 15, and the cited Wikipedia section does not cure these deficiencies, the combination of Dubrow and the cited Wikipedia section cannot anticipate claims 1, 10 or 15, or claims 3, 12 and 17, which depend therefrom.

Accordingly, it is respectfully requested that the rejection of claims 3, 12, and 17 under 35 U.S.C. § 102(b) as being anticipated by Dubrow et al. as evidenced by Wikipedia, be reconsidered and withdrawn.

The rejection of claims 6, 7, and 9 under 35 U.S.C. § 102(e) as being anticipated by Quellet et al., is respectfully traversed based on the following.

As noted above, the present application discloses various embodiments and components for microfluidic devices which provide a simplified structure and certain advantages in configuration and use. Claim 6 is directed to a microfluidic device of the type having a pump unit and a channel unit. Claim 6, as amended herein, recites:

A microfluidic device comprising:
a pump unit including:
a first joint surface;
a pumping mechanism; and
a first channel that forms a flow path through which a fluid flows, opposing ends of said first channel each opening to the first joint surface, said pumping mechanism being disposed adjacent to said channel and being configured to control a flow of fluid through said channel;
a channel unit including a second joint surface and a second channel opening to the second joint surface; and
a sheet-like member including a third joint surface to be bonded to the first joint surface, a fourth joint surface to be bonded to the second joint surface and a connection hole for connecting the first channel and the second channel,
wherein the sheet-like member is made from an elastic material having a self-sealing feature and is detachably joined to at least one of the channel unit and the pump unit.

Thus, the invention of claim 6 includes a pump unit having several parts and a channel unit. Specifically, as set forth in the claim, the pump unit includes a first joint surface and a channel through which the fluid is moved by the pumping mechanism. Importantly, the channel has opposing ends, **both** of which open to the first joint surface.

In this configuration, fluid may be drawn from a reservoir which may be is located on the side of the channel unit, received at the pump unit at the first joint surface, moved through the channel of pump unit by virtue of the pumping mechanism and returned to the channel unit, again at the first joint surface. This configuration allows a clean separation along the first joint surface between the pump unit and both the source of the fluids and the channels into which the fluids are delivered by the pump unit.

Claim 6 also requires a sheet-like member made from an elastic material having a self-sealing feature and is detachably joined to at least one of the channel unit and the pump unit.

In order to anticipate claim 6, the cited reference must disclose every limitation of the claim. As explained more fully below, Ouellet does not disclose every limitation of claim 6 and thus cannot anticipate this claim (or claims 7 and 9, which depend from claim 6).

Ouellet discloses a method for fabricating a microstructure for microfluidics applications. Specifically, Ouellet discloses a method using semiconductor type micro fabrication techniques that can form a buried channel. That is, Ouellet discloses that an etchable material can be covered with a support layer, a narrow opening can be cut in the support layer, an isotropic etch can be introduced via the narrow opening so as to etch away the underlying etchable material and thus undercut the overlying support layer to form a channel under the overlying support layer. After the undercut is achieved, the narrow opening is closed by depositing an additional layer. Ouellet also discloses that electronic elements can be made at the same time using semiconductor manufacturing techniques. Thus, the teaching of Ouellet is a fabrication technique that allows "the micro-channels [to be] closed without the use of a second substrate and without the use of thermal bonding." (col. 5, lines 22-23).

While Ouellet makes an off hand comment that the disclosed structure can be used with a micropump, Ouellet fails to disclose or illustrate any type or configuration of micropump whatsoever. Ouellet also fails to disclose how or where a micropump would be used with the etched structure. While Ouellet lists various items of prior art, Ouellet does not explain the teachings of this art or suggest how any pump (if any) that might be shown in the art would be configured, used or integrated into the structure shown in Ouellet.

Thus, specifically referring to claim 6, Ouellet does not disclose a microfluidics system of the type having a pump unit which is detachable from the channel unit or one which has the specific configuration set forth in the claim. Ouellet does not disclose a pump unit that includes a first joint surface and a first channel that forms a flow path through which a fluid flows, where opposing ends of the first channel each open to the first joint surface. Ouellet also does not disclose a configuration where a sheet-like member is made from an

elastic material having a self-sealing feature and is detachably joined to at least one of the channel unit and the pump unit in a system of the type claimed.

As discussed above, it is the configuration of the pump unit, the channel unit and the sheet-like member, as claimed, which allow the detachable configuration, and which provide the beneficial effects.

Because, as described above, Ouellet does not disclose all of the specific structural limitations of claim 6, Ouellet is unable to anticipate this claim or claims 7 and 9 which depend from claim 6.

Accordingly, it is respectfully requested that the rejection of claims 6, 7, and 9 under 35 U.S.C. § 102(e) as being anticipated by Quellet et al., be reconsidered and withdrawn.

The rejection of claim 8 under 35 U.S.C. § 102(e) as being anticipated by Quellet et al. as evidenced by Wikipedia, is respectfully traversed based on the following.

Claim 8 depends from claim 6. In order to anticipate or render obvious this claim, Ouellet and the cited Wikipedia section, singly or in combination, would need to disclose every limitation of the claim.

As noted above with respect to claim 6, Ouellet fails to disclose every limitation of this claim. The cited Wikipedia section is relied on for the proposition that PDMS is optically clear. However, regardless of whether or not the cited Wikipedia section discloses that PDMS is optically clear, the cited Wikipedia section does not disclose or suggest the limitations of claim 6, which have been identified above as missing from the Ouellet reference.

Accordingly, because Ouellet fails to anticipate claim 6 and the cited Wikipedia section does not cure these deficiencies, the combination of Ouellet and the cited Wikipedia section cannot anticipate claim 6, or claim 8, which depends therefrom.

Accordingly, it is respectfully requested that the rejection of claim 8 under 35 U.S.C. § 102(e) as being anticipated by Quellet et al. as evidenced by Wikipedia, be reconsidered and withdrawn.

In view of the foregoing amendments and remarks, this application is considered to be in condition for allowance, and an early reconsideration and a Notice of Allowance are respectfully requested.

This Amendment does not increase the number of independent claims, does increase the total number of claims from 18 to 19 (20 claims previously paid for), and does not present any multiple dependency claims. Accordingly, no fee based on the number or type of claims is currently due. However, if a fee, other than the issue fee, is due, please charge this fee to Sidley Austin LLP Deposit Account No. 18-1260.

If an extension of time is required to enable this document to be timely filed and there is no separate Petition for Extension of Time filed herewith, this document is to be construed as also constituting a Petition for Extension of Time Under 37 C.F.R. § 1.136(a) for a period of time sufficient to enable this document to be timely filed.

Any other fee required for such Petition for Extension of Time and any other fee required by this document pursuant to 37 C.F.R. §§ 1.16 and 1.17, other than the issue fee, and not submitted herewith should be charged to Sidley Austin LLP Deposit Account No. 18-1260. Any refund should be credited to the same account.

Respectfully submitted,

By: _____
Thomas N. Tarnay
Registration No. 41,341
Attorney for Applicants

TNT/llb
SIDLEY AUSTIN LLP
717 N. Harwood, Suite 3400
Dallas, Texas 75201
Direct: (214) 981-3388
Main: (214) 981-3300
Facsimile: (214) 981-3400
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